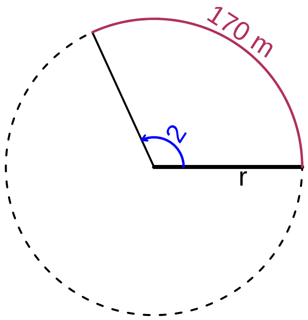
Name: Date:

Trig Final (Solution v0)

- You should have a calculator (like Desmos) and a unit-circle reference sheet.

Question 1

In the figure below, we see a circle and a central angle that subtends an arc. The angle measure is 2 radians. The arc length is 170 meters. How long is the radius in meters?



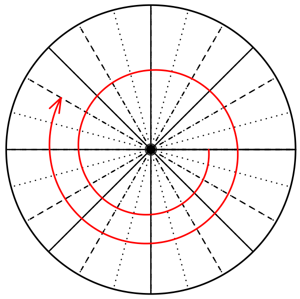
$$\theta = \frac{L}{r} \qquad r = \frac{L}{\theta} \qquad L = r\theta$$

$r = 85$ meters.

Question 2

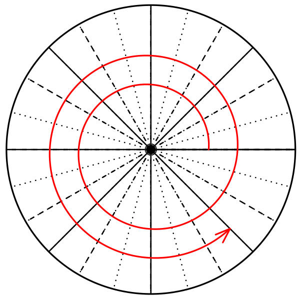
Consider angles $\frac{-19\pi}{6}$ and $\frac{15\pi}{4}$. For each angle, use a spiral with an arrow head to **mark** the angle on a circle below in standard position. Then, find **exact** expressions for $\cos\left(\frac{-19\pi}{6}\right)$ and $\sin\left(\frac{15\pi}{4}\right)$ by using a unit circle (provided separately).

Mark $\frac{-19\pi}{6}$



Find cos(−19π/6)

Mark $\frac{15\pi}{4}$



Find sin(15π/4)

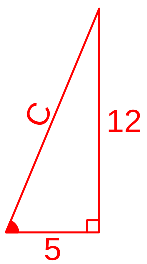
$\cos(-19\pi/6) = \frac{-\sqrt{3}}{2}$

$\sin(15\pi/4) = \frac{-\sqrt{2}}{2}$

Question 3

If $\tan(\theta) = \frac{-12}{5}$, and θ is in quadrant II, determine an exact value for $\sin(\theta)$.

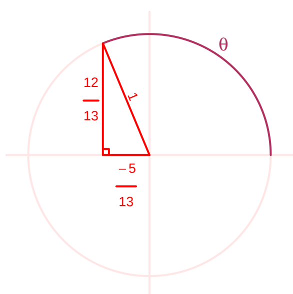
Ignore any negatives and the quadrant, and draw a right triangle (based on SOHCAHTOA) in standard (quadrant I) orientation.



Solve the Pythagorean Equation

$$5^2 + 12^2 = C^2$$
$$C = \sqrt{5^2 + 12^2}$$
$$C = 13$$

Rescale the triangle so the hypotenuse is 1. Reflect the triangle into Quadrant II in a unit circle.



$$\sin(\theta) = \frac{12}{13}$$

Question 4

A mass-spring system oscillates vertically with an amplitude of 7.02 meters, a midline at $y = -4.66$ meters, and a frequency of 8.94 Hz. At $t = 0$, the mass is at the midline and moving down. Write an equation to model the height (y in meters) as a function of time (t in seconds).

Any of these equations would get full credit.

$$y = -7.02 \sin(2\pi 8.94t) - 4.66$$

or

$$y = -7.02 \sin(17.88\pi t) - 4.66$$

or

$$y = -7.02 \sin(56.17t) - 4.66$$

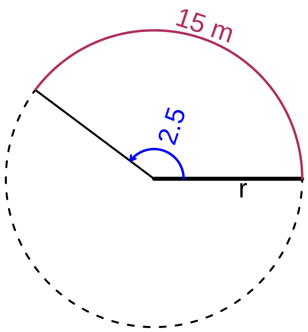
Name: Date:

Trig Final (Solution v1)

- You should have a calculator (like Desmos) and a unit-circle reference sheet.

Question 1

In the figure below, we see a circle and a central angle that subtends an arc. The angle measure is 2.5 radians. The arc length is 15 meters. How long is the radius in meters?



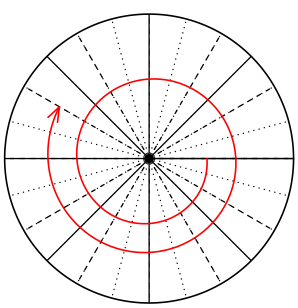
$$\theta = \frac{L}{r} \qquad r = \frac{L}{\theta} \qquad L = r\theta$$

$r = 6$ meters.

Question 2

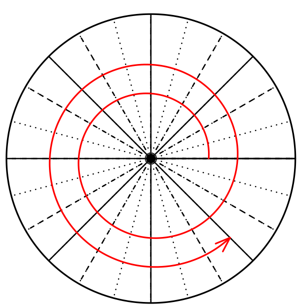
Consider angles $\frac{-19\pi}{6}$ and $\frac{15\pi}{4}$. For each angle, use a spiral with an arrow head to **mark** the angle on a circle below in standard position. Then, find **exact** expressions for $\cos\left(\frac{-19\pi}{6}\right)$ and $\sin\left(\frac{15\pi}{4}\right)$ by using a unit circle (provided separately).

Mark $\frac{-19\pi}{6}$



Find cos(−19π/6)

Mark $\frac{15\pi}{4}$



Find sin(15π/4)

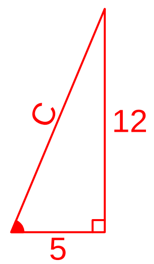
$\cos(-19\pi/6) = \frac{-\sqrt{3}}{2}$

$\sin(15\pi/4) = \frac{-\sqrt{2}}{2}$

Question 3

If $\tan(\theta) = \frac{-12}{5}$, and θ is in quadrant II, determine an exact value for $\sin(\theta)$.

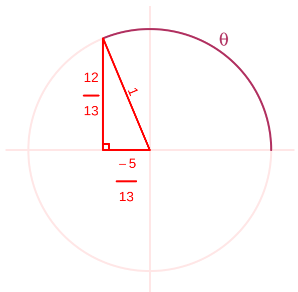
Ignore any negatives and the quadrant, and draw a right triangle (based on SOHCAHTOA) in standard (quadrant I) orientation.



Solve the Pythagorean Equation

$$5^2 + 12^2 = C^2$$
$$C = \sqrt{5^2 + 12^2}$$
$$C = 13$$

Rescale the triangle so the hypotenuse is 1. Reflect the triangle into Quadrant II in a unit circle.



$$\sin(\theta) = \frac{12}{13}$$

Question 4

A mass-spring system oscillates vertically with an amplitude of 7.02 meters, a midline at $y = -4.66$ meters, and a frequency of 8.94 Hz. At $t = 0$, the mass is at the midline and moving down. Write an equation to model the height (y in meters) as a function of time (t in seconds).

Any of these equations would get full credit.

$$y = -7.02\sin(2\pi 8.94t) - 4.66$$

or

$$y = -7.02\sin(17.88\pi t) - 4.66$$

or

$$y = -7.02\sin(56.17t) - 4.66$$

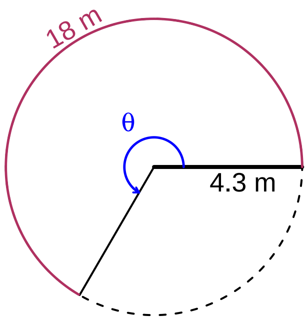
Name: Date:

Trig Final (Solution v2)

- You should have a calculator (like Desmos) and a unit-circle reference sheet.

Question 1

In the figure below, we see a circle and a central angle that subtends an arc. The arc length is 18 meters. The radius is 4.3 meters. What is the angle measure in radians?

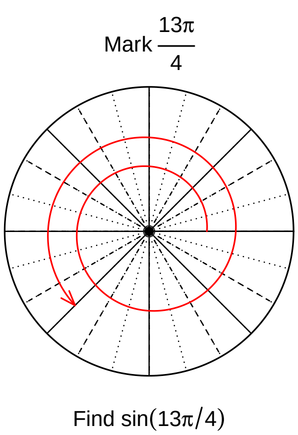


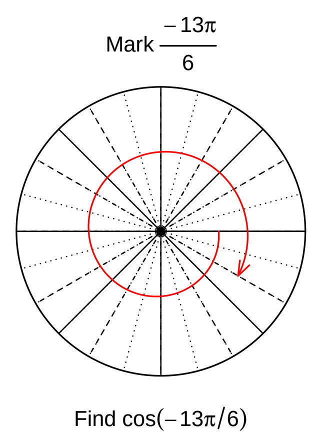
$$\theta = \frac{L}{r} \qquad r = \frac{L}{\theta} \qquad L = r\theta$$

$\theta = 4.186$ radians.

Question 2

Consider angles $\frac{13\pi}{4}$ and $\frac{-13\pi}{6}$. For each angle, use a spiral with an arrow head to **mark** the angle on a circle below in standard position. Then, find **exact** expressions for $\sin\left(\frac{13\pi}{4}\right)$ and $\cos\left(\frac{-13\pi}{6}\right)$ by using a unit circle (provided separately).





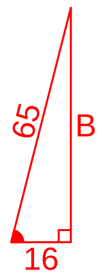
$\sin(13\pi/4) = \frac{-\sqrt{2}}{2}$

$\cos(-13\pi/6) = \frac{\sqrt{3}}{2}$

Question 3

If $\cos(\theta) = \frac{-16}{65}$, and θ is in quadrant III, determine an exact value for $\sin(\theta)$.

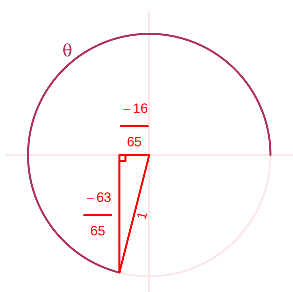
Ignore any negatives and the quadrant, and draw a right triangle (based on SOHCAHTOA) in standard (quadrant I) orientation.



Solve the Pythagorean Equation

$$16^2 + B^2 = 65^2$$
$$B = \sqrt{65^2 - 16^2}$$
$$B = 63$$

Rescale the triangle so the hypotenuse is 1. Reflect the triangle into Quadrant III in a unit circle.



$$\sin(\theta) = \frac{-63}{65}$$

Question 4

A mass-spring system oscillates vertically with a midline at $y = -6.63$ meters, a frequency of 2.52 Hz, and an amplitude of 5.11 meters. At $t = 0$, the mass is at the midline and moving up. Write an equation to model the height (y in meters) as a function of time (t in seconds).

Any of these equations would get full credit.

$$y = 5.11\sin(2\pi 2.52t) - 6.63$$

or

$$y = 5.11\sin(5.04\pi t) - 6.63$$

or

$$y = 5.11\sin(15.83t) - 6.63$$

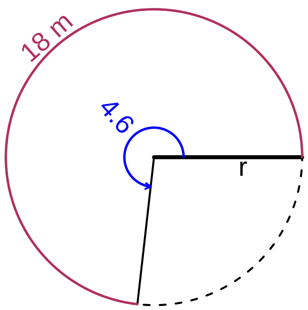
Name: Date:

Trig Final (Solution v3)

- You should have a calculator (like Desmos) and a unit-circle reference sheet.

Question 1

In the figure below, we see a circle and a central angle that subtends an arc. The arc length is 18 meters. The angle measure is 4.6 radians. How long is the radius in meters?



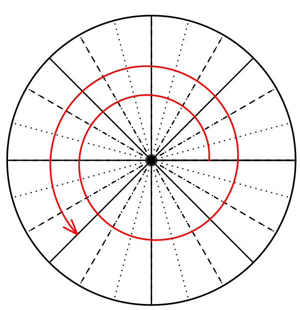
$$\theta = \frac{L}{r} \qquad r = \frac{L}{\theta} \qquad L = r\theta$$

$r = 3.913$ meters.

Question 2

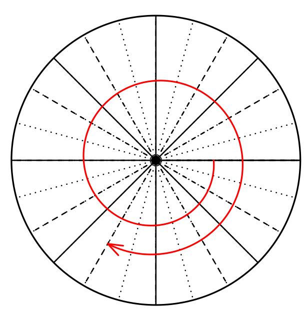
Consider angles $\frac{13\pi}{4}$ and $\frac{-8\pi}{3}$. For each angle, use a spiral with an arrow head to **mark** the angle on a circle below in standard position. Then, find **exact** expressions for $\cos\left(\frac{13\pi}{4}\right)$ and $\sin\left(\frac{-8\pi}{3}\right)$ by using a unit circle (provided separately).

Mark $\frac{13\pi}{4}$



Find cos(13π/4)

Mark $\frac{-8\pi}{3}$



Find sin(−8π/3)

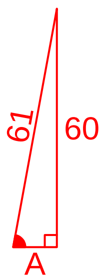
$\cos(13\pi/4) = \frac{-\sqrt{2}}{2}$

$\sin(-8\pi/3) = \frac{-\sqrt{3}}{2}$

Question 3

If $\sin(\theta) = \frac{60}{61}$, and θ is in quadrant II, determine an exact value for $\tan(\theta)$.

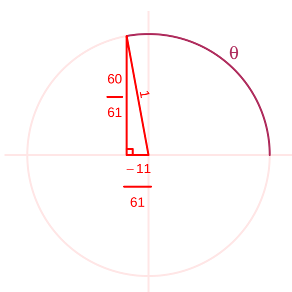
Ignore any negatives and the quadrant, and draw a right triangle (based on SOHCAHTOA) in standard (quadrant I) orientation.



Solve the Pythagorean Equation

$$A^2 + 60^2 = 61^2$$
$$A = \sqrt{61^2 - 60^2}$$
$$A = 11$$

Rescale the triangle so the hypotenuse is 1. Reflect the triangle into Quadrant II in a unit circle.



$$\tan(\theta) = \frac{\frac{60}{61}}{\frac{-11}{61}} = \frac{-60}{11}$$

Question 4

A mass-spring system oscillates vertically with a frequency of 3.66 Hz, a midline at $y = -7.54$ meters, and an amplitude of 2.65 meters. At $t = 0$, the mass is at the midline and moving up. Write an equation to model the height (y in meters) as a function of time (t in seconds).

Any of these equations would get full credit.

$$y = 2.65\sin(2\pi 3.66t) - 7.54$$

or

$$y = 2.65\sin(7.32\pi t) - 7.54$$

or

$$y = 2.65\sin(23t) - 7.54$$

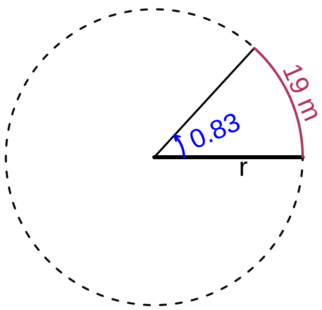
Name: Date:

Trig Final (Solution v4)

- You should have a calculator (like Desmos) and a unit-circle reference sheet.

Question 1

In the figure below, we see a circle and a central angle that subtends an arc. The angle measure is 0.83 radians. The arc length is 19 meters. How long is the radius in meters?



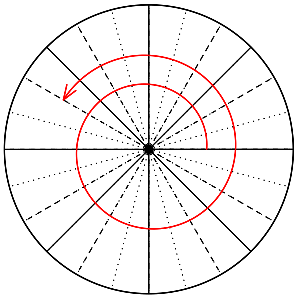
$$\theta = \frac{L}{r} \qquad r = \frac{L}{\theta} \qquad L = r\theta$$

$r = 22.89$ meters.

Question 2

Consider angles $\frac{17\pi}{6}$ and $\frac{-11\pi}{4}$. For each angle, use a spiral with an arrow head to **mark** the angle on a circle below in standard position. Then, find **exact** expressions for $\cos\left(\frac{17\pi}{6}\right)$ and $\sin\left(\frac{-11\pi}{4}\right)$ by using a unit circle (provided separately).

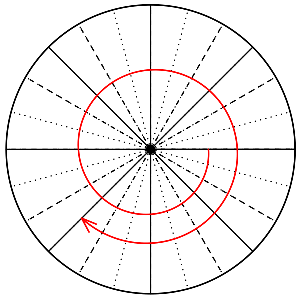
Mark $\frac{17\pi}{6}$



Find cos(17π/6)

$\cos(17\pi/6) = \frac{-\sqrt{3}}{2}$

Mark $\frac{-11\pi}{4}$



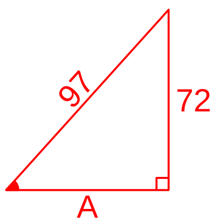
Find sin(−11π/4)

$\sin(-11\pi/4) = \frac{-\sqrt{2}}{2}$

Question 3

If $\sin(\theta) = \frac{-72}{97}$, and θ is in quadrant III, determine an exact value for $\tan(\theta)$.

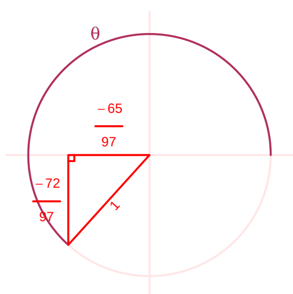
Ignore any negatives and the quadrant, and draw a right triangle (based on SOHCAHTOA) in standard (quadrant I) orientation.



Solve the Pythagorean Equation

$$A^2 + 72^2 = 97^2$$
$$A = \sqrt{97^2 - 72^2}$$
$$A = 65$$

Rescale the triangle so the hypotenuse is 1. Reflect the triangle into Quadrant III in a unit circle.



$$\tan(\theta) = \frac{\frac{-72}{97}}{\frac{-65}{97}} = \frac{72}{65}$$

Question 4

A mass-spring system oscillates vertically with a midline at $y = -7.33$ meters, an amplitude of 6.09 meters, and a frequency of 8.74 Hz. At $t = 0$, the mass is at the minimum height. Write an equation to model the height (y in meters) as a function of time (t in seconds).

Any of these equations would get full credit.

$$y = -6.09\cos(2\pi 8.74t) - 7.33$$

or

$$y = -6.09\cos(17.48\pi t) - 7.33$$

or

$$y = -6.09\cos(54.92t) - 7.33$$

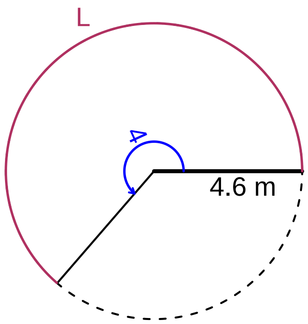
Name: Date:

Trig Final (Solution v5)

- You should have a calculator (like Desmos) and a unit-circle reference sheet.

Question 1

In the figure below, we see a circle and a central angle that subtends an arc. The radius is 4.6 meters. The angle measure is 4 radians. How long is the arc in meters?



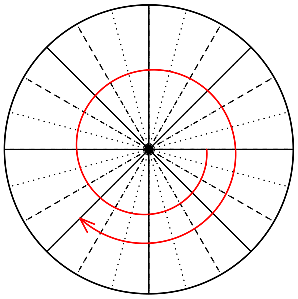
$$\theta = \frac{L}{r} \qquad r = \frac{L}{\theta} \qquad L = r\theta$$

$L = 18.4$ meters.

Question 2

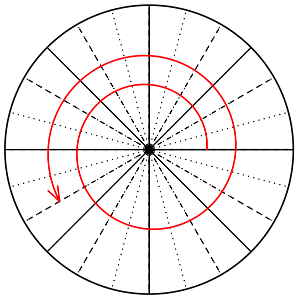
Consider angles $\frac{-11\pi}{4}$ and $\frac{19\pi}{6}$. For each angle, use a spiral with an arrow head to **mark** the angle on a circle below in standard position. Then, find **exact** expressions for $\sin\left(\frac{-11\pi}{4}\right)$ and $\cos\left(\frac{19\pi}{6}\right)$ by using a unit circle (provided separately).

Mark $\frac{-11\pi}{4}$



Find $\sin(-11\pi/4)$

Mark $\frac{19\pi}{6}$



Find $\cos(19\pi/6)$

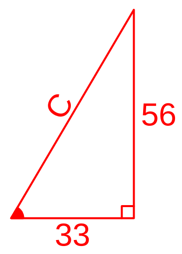
$\sin(-11\pi/4) = \frac{-\sqrt{2}}{2}$

$\cos(19\pi/6) = \frac{-\sqrt{3}}{2}$

Question 3

If $\tan(\theta) = \frac{-56}{33}$, and θ is in quadrant IV, determine an exact value for $\sin(\theta)$.

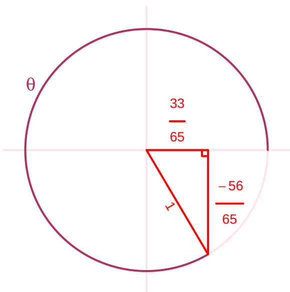
Ignore any negatives and the quadrant, and draw a right triangle (based on SOHCAHTOA) in standard (quadrant I) orientation.



Solve the Pythagorean Equation

$$33^2 + 56^2 = C^2$$
$$C = \sqrt{33^2 + 56^2}$$
$$C = 65$$

Rescale the triangle so the hypotenuse is 1. Reflect the triangle into Quadrant IV in a unit circle.



$$\sin(\theta) = \frac{-56}{65}$$

Question 4

A mass-spring system oscillates vertically with a frequency of 2.42 Hz, a midline at $y = 3.93$ meters, and an amplitude of 5.11 meters. At $t = 0$, the mass is at the minimum height. Write an equation to model the height (y in meters) as a function of time (t in seconds).

Any of these equations would get full credit.

$$y = -5.11\cos(2\pi 2.42t) + 3.93$$

or

$$y = -5.11\cos(4.84\pi t) + 3.93$$

or

$$y = -5.11\cos(15.21t) + 3.93$$

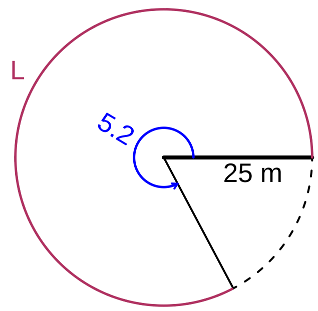
Name: Date:

Trig Final (Solution v6)

- You should have a calculator (like Desmos) and a unit-circle reference sheet.

Question 1

In the figure below, we see a circle and a central angle that subtends an arc. The angle measure is 5.2 radians. The radius is 25 meters. How long is the arc in meters?



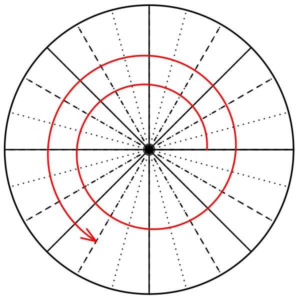
$$\theta = \frac{L}{r} \qquad r = \frac{L}{\theta} \qquad L = r\theta$$

$L = 130$ meters.

Question 2

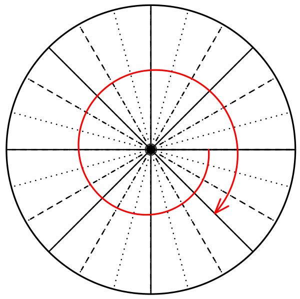
Consider angles $\frac{10\pi}{3}$ and $\frac{-9\pi}{4}$. For each angle, use a spiral with an arrow head to **mark** the angle on a circle below in standard position. Then, find **exact** expressions for $\cos\left(\frac{10\pi}{3}\right)$ and $\sin\left(\frac{-9\pi}{4}\right)$ by using a unit circle (provided separately).

Mark $\frac{10\pi}{3}$



Find cos(10π/3)

Mark $\frac{-9\pi}{4}$



Find sin(−9π/4)

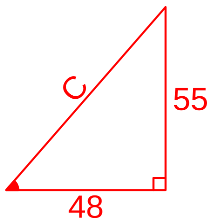
$\cos(10\pi/3) = \frac{-1}{2}$

$\sin(-9\pi/4) = \frac{-\sqrt{2}}{2}$

Question 3

If $\tan(\theta) = \frac{-55}{48}$, and θ is in quadrant IV, determine an exact value for $\sin(\theta)$.

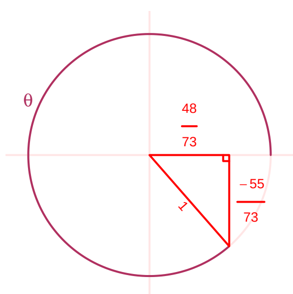
Ignore any negatives and the quadrant, and draw a right triangle (based on SOHCAHTOA) in standard (quadrant I) orientation.



Solve the Pythagorean Equation

$$48^2 + 55^2 = C^2$$
$$C = \sqrt{48^2 + 55^2}$$
$$C = 73$$

Rescale the triangle so the hypotenuse is 1. Reflect the triangle into Quadrant IV in a unit circle.



$$\sin(\theta) = \frac{-55}{73}$$

Question 4

A mass-spring system oscillates vertically with a frequency of 6.9 Hz, an amplitude of 3.03 meters, and a midline at $y = -8.71$ meters. At $t = 0$, the mass is at the minimum height. Write an equation to model the height (y in meters) as a function of time (t in seconds).

Any of these equations would get full credit.

$$y = -3.03\cos(2\pi 6.9t) - 8.71$$

or

$$y = -3.03\cos(13.8\pi t) - 8.71$$

or

$$y = -3.03\cos(43.35t) - 8.71$$

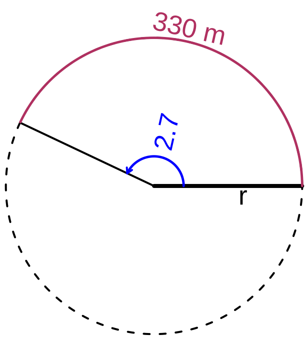
Name: Date:

Trig Final (Solution v7)

- You should have a calculator (like Desmos) and a unit-circle reference sheet.

Question 1

In the figure below, we see a circle and a central angle that subtends an arc. The arc length is 330 meters. The angle measure is 2.7 radians. How long is the radius in meters?

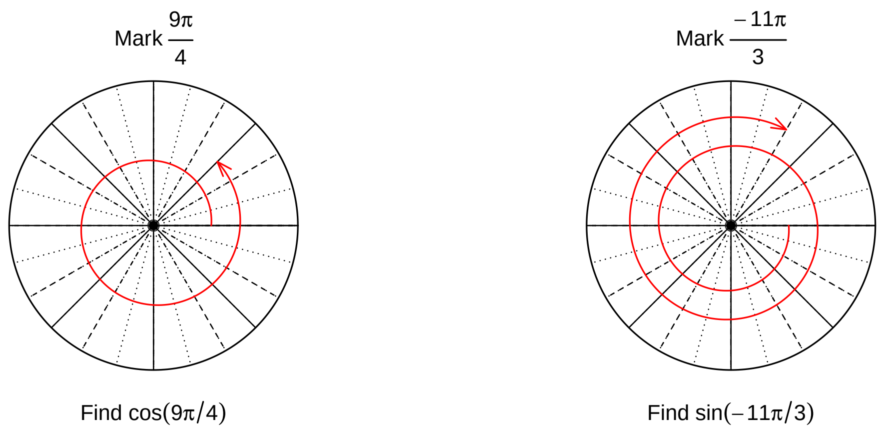


$$\theta = \frac{L}{r} \qquad r = \frac{L}{\theta} \qquad L = r\theta$$

$r = 122.2$ meters.

Question 2

Consider angles $\frac{9\pi}{4}$ and $\frac{-11\pi}{3}$. For each angle, use a spiral with an arrow head to **mark** the angle on a circle below in standard position. Then, find **exact** expressions for $\cos\left(\frac{9\pi}{4}\right)$ and $\sin\left(\frac{-11\pi}{3}\right)$ by using a unit circle (provided separately).



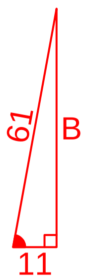
cos(9π/4)= $\frac{\sqrt{2}}{2}$

sin(-11π/3)= $\frac{\sqrt{3}}{2}$

Question 3

If $\cos(\theta) = \frac{-11}{61}$, and θ is in quadrant III, determine an exact value for $\sin(\theta)$.

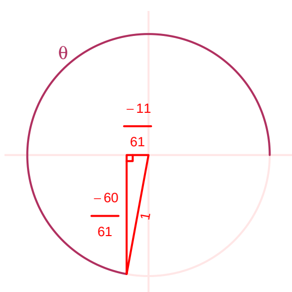
Ignore any negatives and the quadrant, and draw a right triangle (based on SOHCAHTOA) in standard (quadrant I) orientation.



Solve the Pythagorean Equation

$$11^2 + B^2 = 61^2$$
$$B = \sqrt{61^2 - 11^2}$$
$$B = 60$$

Rescale the triangle so the hypotenuse is 1. Reflect the triangle into Quadrant III in a unit circle.



$$\sin(\theta) = \frac{-60}{61}$$

Question 4

A mass-spring system oscillates vertically with a midline at $y = 6.76$ meters, a frequency of 4.54 Hz, and an amplitude of 8.8 meters. At $t = 0$, the mass is at the midline and moving down. Write an equation to model the height (y in meters) as a function of time (t in seconds).

Any of these equations would get full credit.

$$y = -8.8\sin(2\pi 4.54t) + 6.76$$

or

$$y = -8.8\sin(9.08\pi t) + 6.76$$

or

$$y = -8.8\sin(28.53t) + 6.76$$

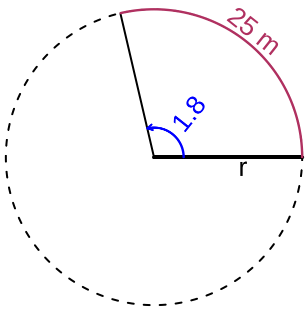
Name: Date:

Trig Final (Solution v8)

- You should have a calculator (like Desmos) and a unit-circle reference sheet.

Question 1

In the figure below, we see a circle and a central angle that subtends an arc. The arc length is 25 meters. The angle measure is 1.8 radians. How long is the radius in meters?

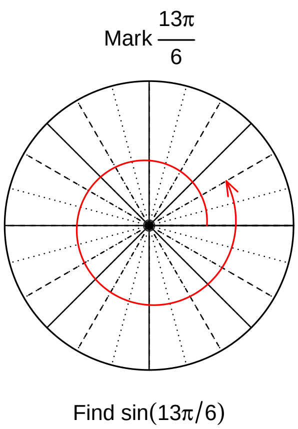


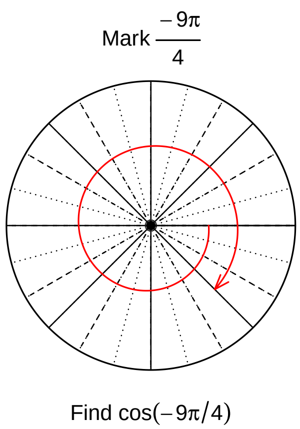
$$\theta = \frac{L}{r} \qquad r = \frac{L}{\theta} \qquad L = r\theta$$

$r = 13.89$ meters.

Question 2

Consider angles $\frac{13\pi}{6}$ and $\frac{-9\pi}{4}$. For each angle, use a spiral with an arrow head to **mark** the angle on a circle below in standard position. Then, find **exact** expressions for $\sin\left(\frac{13\pi}{6}\right)$ and $\cos\left(\frac{-9\pi}{4}\right)$ by using a unit circle (provided separately).





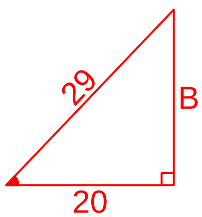
$\sin(13\pi/6) = \frac{1}{2}$

$\cos(-9\pi/4) = \frac{\sqrt{2}}{2}$

Question 3

If $\cos(\theta) = \frac{20}{29}$, and θ is in quadrant IV, determine an exact value for $\tan(\theta)$.

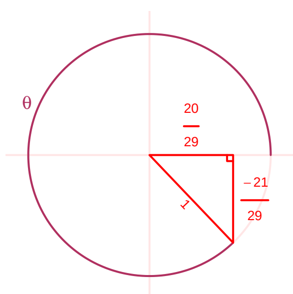
Ignore any negatives and the quadrant, and draw a right triangle (based on SOHCAHTOA) in standard (quadrant I) orientation.



Solve the Pythagorean Equation

$$20^2 + B^2 = 29^2$$
$$B = \sqrt{29^2 - 20^2}$$
$$B = 21$$

Rescale the triangle so the hypotenuse is 1. Reflect the triangle into Quadrant IV in a unit circle.



$$\tan(\theta) = \frac{\frac{-21}{29}}{\frac{20}{29}} = \frac{-21}{20}$$

Question 4

A mass-spring system oscillates vertically with a midline at $y = -6.28$ meters, a frequency of 2.68 Hz, and an amplitude of 8.84 meters. At $t = 0$, the mass is at the midline and moving down. Write an equation to model the height (y in meters) as a function of time (t in seconds).

Any of these equations would get full credit.

$$y = -8.84\sin(2\pi 2.68t) - 6.28$$

or

$$y = -8.84\sin(5.36\pi t) - 6.28$$

or

$$y = -8.84\sin(16.84t) - 6.28$$

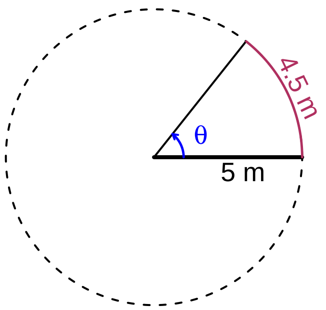
Name: Date:

Trig Final (Solution v9)

- You should have a calculator (like Desmos) and a unit-circle reference sheet.

Question 1

In the figure below, we see a circle and a central angle that subtends an arc. The radius is 5 meters. The arc length is 4.5 meters. What is the angle measure in radians?



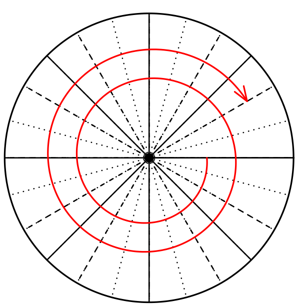
$$\theta = \frac{L}{r} \qquad r = \frac{L}{\theta} \qquad L = r\theta$$

$\theta = 0.9$ radians.

Question 2

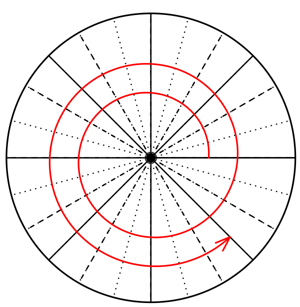
Consider angles $\frac{-23\pi}{6}$ and $\frac{15\pi}{4}$. For each angle, use a spiral with an arrow head to **mark** the angle on a circle below in standard position. Then, find **exact** expressions for $\cos\left(\frac{-23\pi}{6}\right)$ and $\sin\left(\frac{15\pi}{4}\right)$ by using a unit circle (provided separately).

Mark $\frac{-23\pi}{6}$



Find $\cos(-23\pi/6)$

Mark $\frac{15\pi}{4}$



Find $\sin(15\pi/4)$

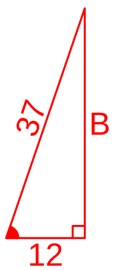
$\cos(-23\pi/6) = \frac{\sqrt{3}}{2}$

$\sin(15\pi/4) = \frac{-\sqrt{2}}{2}$

Question 3

If $\cos(\theta) = \frac{-12}{37}$, and θ is in quadrant III, determine an exact value for $\tan(\theta)$.

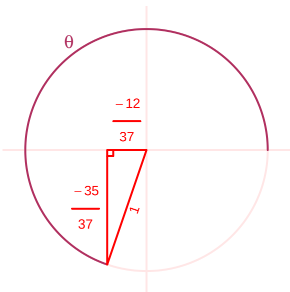
Ignore any negatives and the quadrant, and draw a right triangle (based on SOHCAHTOA) in standard (quadrant I) orientation.



Solve the Pythagorean Equation

$$12^2 + B^2 = 37^2$$
$$B = \sqrt{37^2 - 12^2}$$
$$B = 35$$

Rescale the triangle so the hypotenuse is 1. Reflect the triangle into Quadrant III in a unit circle.



$$\tan(\theta) = \frac{\frac{-35}{37}}{\frac{-12}{37}} = \frac{35}{12}$$

Question 4

A mass-spring system oscillates vertically with a midline at $y = -5.28$ meters, a frequency of 8.81 Hz, and an amplitude of 3.4 meters. At $t = 0$, the mass is at the maximum height. Write an equation to model the height (y in meters) as a function of time (t in seconds).

Any of these equations would get full credit.

$$y = 3.4\cos(2\pi 8.81t) - 5.28$$

or

$$y = 3.4\cos(17.62\pi t) - 5.28$$

or

$$y = 3.4\cos(55.35t) - 5.28$$